Risk Assessment Work Plan, Revision 2
Three Kids Mine
Henderson, Nevada

Prepared for:

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Project No. 14-01-156

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Alan Pineda, PE
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Nevada Division of Environmental Protection
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Attn: Mr. Pineda

Re: Risk Assessment Work Plan, Revision 2
Three Kids Mine

Dear Mr. Pineda:

Broadbent & Associates, Inc. (Broadbent) is pleased to submit this *Risk Assessment Work Plan, Revision 2*. Please do not hesitate to contact us if you should have any questions or require additional information.

Sincerely,
BROADBENT & ASSOCIATES, INC.

Kirk Stowers, CEM
Principal Geologist

cc: JD Dotchin, NDEP
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Three Kids Mine
Henderson, Nevada

REVIEW AND APPROVAL:

JURAT: I, Karen Gastineau, hereby certify that I am responsible for the services in this document and for the preparation of this document. The services described in this document have been provided in a manner consistent with the current standards of the profession and to the best of my knowledge comply with all applicable federal, state and local statutes, regulation and ordinances.

April 15, 2022

Karen Gastineau
CEM #2468 (4/1/2023)

Date

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1.0 INTRODUCTION

1.1 OVERVIEW

The Three Kids Mine and Mill Site (the Site) is a former manganese mine and milling operation located in southern Nevada. Mining and mill processes, land disposal of solid wastes, and trespassing activities have resulted in the presence of elevated levels of hazardous substances. The Site includes 18 private and public parcels totaling approximately 1,165 acres, located northeast of the City of Henderson in Clark County, Nevada. Lakemoor Ventures, LLC (Lakemoor) is working with the Nevada Division of Environmental Protection (NDEP) and the City of Henderson to prepare a remediation plan that will allow the Site to be developed as a mixed-use community. Lakemoor commissioned this Risk Assessment Work Plan to set forth the technical approach, procedures, and methodology for completion of post-remediation risk assessments, which are required as part of the development process.

The risk assessments will be performed to evaluate potential risks to human health and the environment due to exposure to residual concentrations of site-related chemicals (SRCs) in affected media following remediation. The identification of SRCs was detailed in the Phase II Sampling and Analysis Plan (SAP) and primarily includes metals (Broadbent 2021a).

1.2 AUTHORIZATION

In late 2020, Lakemoor hired Broadbent and Associates, Inc. (Broadbent) as part of their site development team. The team also includes EA Engineering, Science, and Technology, Inc., (EA), a subconsultant to Broadbent. Broadbent was retained to facilitate the site investigation and cleanup framework within an accelerated time frame.

1.3 LIMITATIONS

Broadbent planned this work plan to present and gain concurrence with the approach and methodology that will be followed to complete human health and ecological risk assessments at the Site. The risk assessments are required as part of the development process to ensure that the Site has been sufficiently remediated to allow for the planned future land uses. Broadbent relied on publicly available databases, statements of others, reports previously prepared by others, and visual inspection of the Site to identify the proposed sampling locations and chemicals of potential concern. No warranty expressed or implied is made, and Broadbent assumes no liability for any loss resulting from errors or omissions arising from the use of inaccurate/incomplete information or misrepresentations made by others. Third parties who rely on this report shall do so at their own risk.

1.4 PROJECT TEAM

This report was developed under the oversight of a State of Nevada Certified Environmental Manager in good standing (Nevada Administrative Code [NAC] § 459). Resumes of key project staff have been previously provided to Lakemoor.

This document was prepared by the following team:

Cynthia Cheatwood, EA Senior Risk Assessor
Karen Gastineau, Broadbent Project Manager
Jay Snyder, EA Senior Geological Engineer

2.0 BACKGROUND

2.1 SITE DESCRIPTION

2.1.1 Site Location

The Site is located approximately five miles northeast of central Henderson, Nevada, along East Lake Mead Drive (State Road 146). The Site occupies most of Section 35 and parts of Sections 26, 34, and 36 of Township 21S, Range 63E of the Mount Diablo Meridian. The approximate center of the Site is at 36°05'00"N latitude and 114°54'50"W longitude. Access to most of the Site is gained via unpaved roads heading southeast from Lake Mead Drive just east of Henderson. Three small portions of the Site are located north of Lake Mead Drive and can be accessed by foot. A general location map is provided as Figure 1.

The Site consists of approximately 1,165 acres in 18 parcels. These parcels have been given ID numbers as shown in Figure 2. Seven parcels totaling approximately 851 acres are under federal administration. The remaining 314 acres are distributed across 11 parcels, owned variously by three different private entities.

2.1.2 Physical Description

The Site is the location of the former Three Kids Mine. From 1917 to 1961, the Site was utilized for the mining of manganese. Milling, to beneficiate the manganese, began in 1942 and ended in 1961.

There are four open pits on the Site: Three Kids Pit, combined A and B Pits, Hydro Pit, and Hulin Pit. The location of each is indicated on Figure 3. In the process of mining the ore, volumes of overburden (rock and soil excavated during mining to allow access to the ore) were stripped from the pits and left in piles near the pits or were utilized to construct dams. Mill building foundations are still present in part or in whole at the Site, as are remnants of eight circular flotation cells used in the manganese beneficiation process. Tailings are the processed ore discharged from a mill (NAC 445A.381). The beneficiation process produced a tailings slurry that was fed to on-site tailings ponds. Three ponds were created for this purpose in the west-central portion of the Site. The pits, overburden, mill site, and tailings compose the bulk of the large features visible in the disturbed area at the present time.

Unpermitted salvage, dumping, and vandalism has occurred since the mine closure. A dump area near the Hulin Pit was permitted by Clark County as a landfill from 1979 to 1984, during which time it received friable asbestos and drums of waste.

In 1982 a portion of the privately held land was developed into a boat storage facility (currently known as Lake Mead Boat Storage) and a gas station/convenience store (currently known as Laker Plaza). Other privately owned parcels were assembled by an entity composed of three local businessmen under the name Three Kids Enterprises, LLP (TKE).

Lakemoor is currently working with the NDEP and the City of Henderson to prepare a remediation plan for the combined private and public lands affected by the mine and mill operations, with the exception of three private parcels consisting of Lake Mead Boat Storage and Laker Plaza.

3.0 HUMAN HEALTH RISK ASSESSMENT METHODOLOGY

This section describes the methodology, technical approach, and tasks that human health risk assessments (HHRAs) will follow to assess post-remediation site conditions. The HHRAs will follow the procedures and methodologies set forth by the U.S. Environmental Protection Agency (USEPA). Specific guidance documents used to evaluate potential risks to human health include the following:

Risk Assessment Guidance for Superfund (RAGS), *Volume I: Human Health Evaluation Manual (Part A) (Interim Final)*, USEPA/540/1-89/002). December 1989.

RAGS, Volume I: Human Health Evaluation Manual Supplemental Guidance – “Standard Default Exposure Factors” (Interim Final), Publication 9285.6-03. 25 March 1991a.

RAGS, Volume I – Human Health Evaluation Manual (Part B – Development of Risk-based Preliminary Remediation Goals). USEPA/540/R-92/003. December 1991b.

Guidelines for Data Usability in Risk Assessment (Part A). Office of Solid Waste and Emergency Response (OSWER), Publication OSWER 9285.7-09A. April 1992.

RAGS, Volume I: Human Health Evaluation Manual (Part D, Standardized Planning, Reporting and Review of Superfund Risk Assessments). Office of Emergency and Remedial Response. December 2001.

Human Health Toxicity Values in Superfund Risk Assessments. OSWER 9285.7-53. Office of Emergency and Remedial Response. December 2003.

RAGS, *Volume I: Human Health Evaluation Manual (Part E: Supplemental Guidance for Dermal Risk Assessment)* Final, USEPA/540/R/99/005, OSWER 9285.7-02EP, Office of Superfund Remediation and Technology Innovation. July 2004.

Guidelines for Carcinogen Risk Assessment. Risk Assessment Forum. USEPA/630/P-03/001F. March 2005a.

Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens. Risk Assessment Forum, USEPA/630/R-03/003F. March 2005b.

RAGS. Volume I: Human Health Evaluation Manual (Part F: Supplemental Guidance for Inhalation Risk Assessment) Final. Office of Superfund Remediation and Technology Innovation, USEPA-540-R-070-002. January 2009.

Exposure Factors Handbook, *2011 Edition*. USEPA/600/R-090/052F. September 2011.

Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Exposure Factors, OSWER Directive 9200.1-120-Update. 6 February 2014.

Following USEPA guidance (USEPA 1989), the HHRA methodology involves a four-step process: data evaluation and hazard assessment, exposure assessment, toxicity assessment, and risk characterization. The following sections detail each step.

3.1 DATA EVALUATION AND HAZARD ASSESSMENT

In the data evaluation and hazard assessment, available environmental data are compiled and reviewed. Available data may include pre- and post-remediation samples. The site environmental data are analyzed to evaluate whether if they are of sufficient quality for use in the HHRA. Data quality is evaluated using analytical qualifiers applied during the data validation process. Data validation will be performed in accordance with USEPA National Functional Guidelines for Data Review and NDEP Data Validation Guidance (NDEP 2018). The inclusion or exclusion of data based on analytical qualifiers will be performed in accordance with USEPA RAGS Part A (1989), USEPA Guidance for Data Usability in Risk Assessment (USEPA 1992), and NDEP September 2010 Revised Data Usability Guidance (NDEP 2010). The following procedures will be followed for sample results with data qualifiers:

- Analytical results bearing the U qualifier (indicating that the analyte is not detected at the given reporting limit [RL]) will be retained in the data set and considered non-detects. Each non-detected chemical of potential concern (COPC) is assigned a numerical value equal to its RL. For "U" qualified data resulting from higher dilution levels, the result from the undiluted or initial run will be included.
- Analytical results bearing the J qualifier (indicating that the reported value is estimated), will be retained at the reported concentration.
- Analytical results bearing the R qualifier (indicating that the data were rejected) will not be evaluated in the HHRA.

If duplicate samples are collected, the following guidelines will be employed to select the appropriate sample measurement:

- If both samples show that the analyte is present, the maximum detected concentration of the two results will be retained in the dataset.
- If both samples show non-detect values, the minimum of the two non-detect RLs will be retained in the dataset.
- If only one sample indicated that the analyte was present, the detected value will be retained in the dataset and the non-detect value will be discarded.

3.1.1 Risk-Based Screening

Risk-based screening identifies analytes that warrant further evaluation in the HHRA. When an analyte is detected at a concentration less than its respective risk-based criteria, exposure is not expected to result in health effects or concerns, and the analyte will not be considered further in the HHRA. Analytes detected at concentrations that exceed their respective risk-based screening criteria do not necessarily represent a health concern. Instead, the results of the screening identify those analytes that warrant a more detailed, site-specific evaluation to evaluate whether health effects may occur. Risk-based screening will be conducted by comparing maximum detected analyte concentrations to risk-based screening concentrations.

The USEPA regional screening levels (RSLs) (May 2021 or most current version) will be the primary screening levels used for risk-based screening purposes in the HHRA. The USEPA RSLs combine human health toxicity values with "default" exposure scenarios to estimate analyte concentrations in environmental media that are considered by USEPA to be protective of human exposures (including sensitive populations) over a lifetime. For instance, a residential scenario assumes a standard exposure of 350 days per year over a 26-year duration.

The RSLs are based on specific, conservative, fixed levels of risk. For carcinogens, this is 10^{-6}, which is the lower bound for excess lifetime potential carcinogenic risk as defined by the National Oil and Hazardous Substances Pollution Contingency Plan, more commonly called the National Contingency Plan or NCP (USEPA 1990). For non-carcinogens, the RSLs will be based on a hazard quotient (HQ) of 0.1 to account for potential cumulative effects of multiple contaminants affecting the same target organ. The USEPA RSL table identifies some carcinogenic contaminants where the carcinogenic RSL is greater than one-tenth the non-carcinogenic RSL (identified in the USEPA RSL tables as "c**"). In these instances, the more conservative one-tenth the non-carcinogenic RSL will be used.

In addition to the RSLs, detected metals will be compared to background concentrations. The determination of background concentrations is presented in the *Background Soil Report* (Broadbent 2022). For all datasets, the initial step will include a comparison of the maximum detected concentration to background threshold values (BTVs). Hypothesis testing may be conducted for larger datasets (i.e., ten or more samples) if the maximum detected concentration exceeds the BTV. Hypothesis testing will be performed using the USEPA ProUCL program (USEPA 2016).

Analytes that exceed the RSLs and background concentrations will be considered COPCs. Analytes identified as COPCs will be evaluated further in the HHRA. Additionally, detected analytes that have an RL greater than or equal to the RSLs will be retained in the HHRA and discussed in the uncertainty section.

3.1.2 Data Summary

The selection of COPCs will be summarized in a table containing the following information: the maximum detected concentration, detection limit, frequency of detection, screening levels, background concentrations, and rationale for excluding or including the analyte as a COPC. The results will be presented following the USEPA RAGS D format (USEPA 2001).

3.2 EXPOSURE ASSESSMENT

The exposure assessment is conducted to identify the persons that are or may be exposed to the Site, the pathways through which they are potentially exposed, and the magnitude of these potential exposures. The information required to quantify the magnitude of exposure includes the COPC concentrations in each media to which receptors are exposed (i.e., exposure point concentrations [EPCs]) and receptor-specific exposure or intake factors that determine the amount of chemical that enters the body (either orally, absorbed through the skin, or via inhalation).

The exposure assessment includes the following steps:

- Evaluating the exposure setting, which includes a description of the land use and the potentially exposed human populations.
- Developing the conceptual site model (CSM), which identifies complete exposure pathways and the potentially exposed populations.
- Calculating EPCs for each COPC for each of the complete exposure pathways identified in the CSM.
- Identifying the exposure models and parameters with which to calculate the exposure intakes.
- Calculating exposure intakes.

3.2.1 Exposure Setting

The Site consists of approximately 1,266 acres. The mill site was located in the northeast corner of the property. Mill building foundations are still present in part or in whole at the Site, as are remnants of eight circular flotation cells used in the manganese beneficiation process. There are four noticeable open pits on the property: the Three Kids Pit, the combined A and B Pits, the Hydro Pit, and the Hulin Pit. Tailings were pumped into ponds constructed in the central and western portions of the site. The pits, waste rock, mill site, and tailings comprise the bulk of the large features visible at the present time. Based on previous investigations and visual observation and process knowledge, it is estimated that 411 of the 1,266 total acres of the Site have been negatively impacted. These 411 acres are referred to as “the disturbed area”. Exposure to SRCs that may be present in the disturbed area is currently managed through Site trespassing/access controls. However, there is evidence of continuing trespassing activities.

The Site is currently undeveloped, except for Parcels 2, 3, and 4. Parcels 2, 3, and 4 are the Laker Plaza and Lake Mead Boat Storage facilities. Lakemoor is currently working with NDEP and the City of Henderson to put forth a remediation plan for the combined private and public lands affected by the mine and mill operations within the disturbed area, with the exception of three private parcels consisting of Lake Mead Boat Storage and Laker Plaza. The presumptive remedy is expected to include the consolidation of tailings and waste rock and depositing these materials into the open pits at the Site and covering with clean fill. However, the presumptive remedy will be evaluated through the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process, and a full description of the planned remediation will be detailed in a forthcoming *Corrective Action Plan* and additional CERCLA documents.

Lakemoor is planning to develop the Site as a mixed-use community. Anticipated land uses include residential, schools, recreational, and commercial. Residential development at the Site will likely be a combination of high-density multi-family, medium high density residential, medium density residential, and low density residential. The entire Site will be enhanced by restoration and redevelopment once remediation is complete. To construct parks, structures and residences, the land will be cut and/or filled with clean fill, paved with roads or foundations, and covered with topsoil as needed.

The Site will be redeveloped in several phases. Throughout the redevelopment process, one sub-area (or development phase) will be redeveloped at a time followed by another sub-area. “On-site receptors” are the future receptors that will be located within the sub-area under evaluation based upon the land use planned (e.g., residential, recreational, commercial, etc). “Off-site receptors” are the future receptors that will be located outside of the sub-area under evaluation that may have complete exposure pathways associated with sources within the sub-area.

Groundwater beneath the Site is of insufficient quality to be used as a drinking water supply. Potable water will be supplied to the development by the City of Henderson. The use of private water wells by residents, businesses, or parks for drinking water, irrigation water, or other non-potable uses (e.g., washing cars, filling swimming pools) will not occur in the post-redevelopment phase. Therefore, groundwater is not currently used and will not be used in the future for potable or non-potable uses at the Site. There are no surface water bodies onsite. Additionally, stormwater runoff following site development will be controlled in accordance with the State of Nevada stormwater regulations. Therefore, exposure pathways relating to groundwater use and surface water contact are incomplete.

The leaching of metals and other SRCs from sources (tailings, waste rock, etc.) into native soils beneath the mine wastes will be analyzed as detailed in the Work Plan for Leaching Analysis of Hydro Pit Fill (Broadbent 2021b) and reported in the forthcoming Leaching Analysis Report. It is noted that if the leaching analysis identifies a complete pathway to groundwater, a complete exposure pathway for human contact to groundwater at the Site remains incomplete, currently and in the future.

3.2.2 Conceptual Site Model

Based upon the exposure setting, a CSM is formulated that presents the potential exposure populations and exposure pathways. An exposure pathway describes a mechanism by which a population or individual may be exposed to chemicals present at a site. A complete exposure pathway requires the following four components:

- A source and mechanism of chemical release to the environment.
- An environmental transport medium for the released chemical.
- A point of potential human contact with the contaminated medium.
- A human exposure route at the point of exposure.

All four components must exist for an exposure pathway to be complete and for exposure to occur. Incomplete exposure pathways do not result in actual human exposure and are not included in the exposure assessment and resulting risk characterization. The HHRA exposure pathways are receptor-specific and address all potential receptors of concern. Figure 4 presents the CSM.

3.2.2.1 Source Areas and Affected Environmental Media

Sources areas include tailings, waste rock, and other solid media affected from activities associated with the former mining operations. The HHRAs will assess environmental media remaining post-remediation. The primary mechanisms that released contaminants at the Site are leaching and wind erosion/deposition. Metals and other SCRs can be leached from sources (tailings, waste rock, etc) into native soils beneath the mine wastes. In addition, erosion of surface waste rock/tailings may result in transport of materials across the Site from the source areas to exposed native soil. Due to the barren nature of the surface waste rock and tailings piles, wind transport of fines also has the potential to spread these materials, and this mechanism is observable onsite.

3.2.2.2 Complete Exposure Pathways

Development of the Site will require areas of cut and fill. It is anticipated that some sub-areas will be filled with at least 10 ft of clean fill as detailed in the forthcoming *Corrective Action Plan.* These subareas that have 10 ft of clean fill will not be evaluated quantitatively in the post-remediation HHRA after the placement of clean fill due to incomplete exposure pathways.

The following receptors are identified for the Site following remediation:

- On-site Resident (adult and child)
- School users (adult, adolescent, child)
- Recreational user (child, adolescent, and adult)
- Commercial user (child, adolescent, and adult)
- Landscaper/Maintenance worker (adult)
- Construction worker (adult)

Residential development at the Site will likely be a combination of high-density multi-family, medium-high density residential, medium-density residential, and low-density residential. Active adult housing is also a potential residential development category. Two age groups are considered for the residential scenario, an adult and a child. The age range for the child is assumed to be 0-6 years. The resident adult is evaluated for the age range of 7-26 years (USEPA 1991b and 2021a). Although adults are typically assumed at an age range of greater than 16 years of age, the resident adult is evaluated for a long-term exposure typical of residents (USEPA 1991b). Residents are typically assumed to live at a residence for a duration of 26 years; therefore, the resident adult spans the 7-26 years beyond childhood (USEPA 1991b and 2021a). To account for construction of pools, basements, or other subsurface excavations, the resident is assumed to contact soil both at the surface and at depths of up to 10 ft below ground surface (bgs).

There is a potential for the Site to contain multiple areas for schools. At this time, the types of schools have not been identified; therefore, the age range of infant to adult is assumed for this use. It is anticipated that the evaluation of the school sites will have to meet unrestricted use (i.e., residential use). Therefore, the HHRA will assess the school sites as residential exposure areas. The residential exposure assessment will serve as a surrogate exposure for school receptors. However, the assessment of the school sites will only assess surface soil.

Recreational land use is expected to include neighborhood parks and trails. Recreational users will likely be from the surrounding community; however, visitors from outside the community are also probable. Therefore, the age range of potential recreational users is expected to span from child to adult. It is also expected that the recreational areas will be maintained by a landscaper/maintenance worker, who is assumed to be an adult worker.

Commercial uses at the Site will likely be shops and other stores within community centers. Receptors within these centers will be a range of age groups for both workers (adolescent and adult) and visitors (child, adolescent, and adult). Visitors within these commercial areas are short-term, low frequency receptors who are not likely to have contact with soil surrounding the area. Areas surrounding commercial areas will be maintained by landscapers/maintenance workers. These receptors are expected to have longer-term exposure with higher contact rates. Therefore, the commercial area receptors will be assessed with the landscapers/maintenance workers. These receptors are only expected to contact surface soil.

Construction workers represent all workers that will assist in the development of the Site. This includes construction of all buildings, utility installation, and remediation of areas for anticipated planned uses. Construction workers are anticipated to have contact with shallow and deeper soil.

Based on the above identification of potential receptors and anticipated post-remediation land uses, the HHRAs are expected to evaluate the following receptors. The specific receptors evaluated in the HHRA for any given sub-area will be based upon the anticipated land use for that sub-area as determined during the re-development process:

- Resident (adult and child).
- Construction Worker (adult).
- Landscaper/Maintenance Worker (adult).
- Recreational User (child, adolescent, adult).

Trespassers are also a possibility throughout areas of the development. The trespasser is a short-term, low frequency receptor. The assessment of the receptors identified above will be protective of any trespassers that may contact the Site post-remediation.

The only complete exposure pathway is contact with soil. All future receptors are expected to have direct contact with surface soil (0-2 ft bgs). Only the construction worker and resident will potentially contact subsurface soil (2-10 ft bgs). The exposure routes identified for each receptor are:

- Incidental ingestion of soil.
- Dermal contact with soil.
- Inhalation of particulates/dust released to outdoor air from wind erosion.

3.2.3 Exposure Point Concentrations

The concentration of COPCs in soil varies spatially. The anticipated level of contamination to which a receptor is exposed (i.e., the EPC) is likely an average level. Therefore, EPCs are typically represented by average concentrations. The EPC is represented by the 95 percent upper confident limit of the mean (95% UCL) (USEPA1989). The 95% UCL is used because assuming long-term contact with the maximum concentration is not reasonable (USEPA 1989).

The 95% UCL will be determined using the USEPA ProUCL program version 5.1.00 (USEPA 2016). The USEPA ProUCL program determines the distribution, sample size, variance, and recommended 95% UCL for each COPC (USEPA 2016). If the 95% UCL exceeds the maximum detected concentration, the maximum detected concentration will be used as the EPC (USEPA 1989 and 2016).

The determination of the 95% UCL will be based upon the sub-areas identified for the Site based upon the phased development. The size of the exposure area is dependent on the receptor (i.e., residential receptors or worker receptors). For the residential receptor, 1/8th-acre will be used for residential receptors, and 1/2-acre will be used for worker receptors. The sub-area will be covered by a 1/8th-acre or 1/2-acre cell grid network. The 1/8th-acre area corresponds to the size of a typical residential lot size, as presented in USEPA (1989). The overall goal to address human health protection, is to remediate the Site soils such that they are suitable for unrestricted residential uses and/or commercial development. It is noted that although 1/8th-acre and ½-acre areas are the target for exposure, sampling will not occur on many of these exposure areas. Sampling will be randomized across the sub-area. Details about the random sampling will be presented to NDEP for review and approval when more information is available about the development, including development layout, land use, and phases of construction. In addition, all sample results within the sub-areas will be evaluated for areas of higher concentrations that may affect overall risk results.

3.2.4 Calculation of Chemical Intake

The chemical intake is the exposure normalized over time and body weight and expressed in units of milligrams of chemical per kilogram of body weight per day (mg/kg-day). The reasonable maximum exposure (RME) assumption represents the greatest exposure that can be reasonably expected to occur at the Site. Two different measures of intake are provided, depending on the nature of the effect being evaluated. When evaluating longer-term exposures to chemicals that produce adverse non carcinogenic effects, intakes are averaged over the period of exposure (i.e., the averaging time [AT]) (USEPA 1989). This measure of intake is referred to as the average daily intake (ADI) and is a less than lifetime exposure. For chemicals that produce carcinogenic effects, intakes are averaged over an entire lifetime and are referred to as the lifetime average daily intake (LADI) (USEPA 1989).

The following equation is used to estimate the intake associated with incidental ingestion of COPCs in soil by all receptors expected at the Site (USEPA 1989):

$$Intake(mg/kg-day) = \frac{EPC_S\ x\ IRS\ x\ EF\ x\ ED\ x\ RBA\ x\ CF}{BW\ x\ AT}$$

Where:
EPC_S = Chemical concentration in soil (milligrams per kilogram [mg/kg]).
IRS = soil ingestion rate (mg/day).
EF = exposure frequency (days/year).
ED = exposure duration (years).
RBA = relative bioavailability (unitless), assumed 1 for all chemicals except arsenic, which is assumed 0.6 (USEPA 2021a).
CF = conversion factor (10^{-6} kg/mg).
BW = body weight (kg).
AT = averaging time (days)
for non-carcinogens, AT = ED x 365 days/year
for carcinogens, AT = 70 years x 365 days/year.

The following equation is used to estimate the intake associated with direct dermal contact of COPCs in soil (USEPA 1989, 2004):

$$Intake\ (mg/kg-day) = \frac{EPC_s\ x\ SA\ x\ ABS\ x\ AF\ x\ EF\ x\ ED\ x\ CF}{BW\ x\ AT}$$

Where:
EPC_S = chemical concentration in soil (mg/kg).
SA = exposed skin surface area (square centimeter per day [cm^2/day]).
ABS = fraction of chemical absorbed from soil to skin (unitless).
AF = skin adherence factor (milligrams per square centimeter [mg/cm^2]).
EF = exposure frequency (days/year).
ED = exposure duration (years).
BW = body weight (kg).

AT = averaging time (days)
for non-carcinogens, AT = ED x 365 days/year
for carcinogens, AT = 70 years x 365 days/year.
CF = Conversion factor (10^{-6} kg/mg).

For inhalation, exposure concentrations (ECs) are calculated. ECs are time-weighted average concentrations from contaminant concentrations in air, adjusted based on the characteristics of the exposure scenario being evaluated. The generic equation to calculate inhalation EC from soil is given below (USEPA 2009):

$$EC = \frac{EPC_A \; x \; ET \; x \; EF \; x \; ED \; x \; CF_1}{AT \; x \; CF_2}$$

Where:
EC = exposure concentration (micrograms per cubic meter [µg/m^3] or milligrams per cubic meter [mg/m^3]).
EPC_A = chemical concentration in air (mg/m^3).
ET = exposure time (hours/day).
EF = exposure frequency (days/year).
ED = exposure duration (years).
AT = averaging time (days).
for non-carcinogens, AT = ED x 365 days/year
for carcinogens, AT = 70 years x 365 days/year.
CF_1 = conversion factor (1,000 µg/mg) (carcinogenic intakes only).
CF_2 = conversion Factor (24 hours/day).

The concentration of chemicals in air resulting from emissions from soil will be developed following procedures presented in the USEPA Soil Screening guidance (USEPA 2002). The chemical concentration in air is calculated from:

$$EPC_A = EPC_S x \left[\frac{1}{PEF} + \frac{1}{VF}\right]$$

Where:

EPC_A = chemical concentration in air (mg/m^3).
EPC_S = chemical concentration in soil (mg/kg).
PEF = particulate emission factor (cubic meters per kilogram [m^3/kg]).
VF = volatilization factor (m^3/kg).

The PEF relates the concentration of a chemical in soil or sediment with the concentration of dust particles in air. For all receptors, except the construction worker, a PEF value of $1.36x10^9$ m^3/kg is used (USEPA 2002, 2021a). The PEF for the construction worker will take into account particulate matter emissions from unpaved road traffic, wind erosion, excavation soil dumping, dozing, grading, and tilling. The USEPA RSL calculator will be used to determine the PEF for the construction worker. Outputs from the calculator will be provided in the HHRA. The PEF selection in the RSL calculator will include both standard vehicle traffic (unpaved) and other construction activities (wind, grading, dozing, tilling, and excavating) (USEPA

2021a). The area disturbed during construction will be determined based upon the sub-areas, which will be based upon the development phases.

3.2.5 Exposure Parameters

The second step in quantifying intake requires the identification of exposure parameters. Exposure parameters include rates of contact (e.g., ingestion rates, skin surface areas, etc.), EF and duration, BW, and AT. The contact rate reflects the dose of contaminated media contacted per unit time or event. EF and duration are used to estimate the total time of exposure to COPCs in media of concern. The BW represents the average BW over an exposure period (USEPA 1989). Specific exposure parameters for each receptor are chosen based on USEPA guidance (USEPA 1989, 2011, 2014, and 2021a) and other appropriate resources. Table 1 presents the exposure parameters proposed for each receptor.

For all adult receptors (i.e., resident adult, adult recreational user, landscaper/maintenance worker, and construction worker), the body weight is assumed at 80 kg (USEPA 2014). For the child resident and child recreational user, the body weight is assumed at 15 kg based upon an age range of 0 to 6 years (USEPA 2014). For the adolescent recreational user, the body weight is based upon the average of the age range evaluated (i.e., 6 to 16 years) taken from the USEPA *Exposure Factors Handbook* (EFH) Table 8-1 (USEPA 2011).

The exposure duration (ED) for each receptor is based upon USEPA guidance (2014), professional judgement, and the age range evaluated. The resident is expected to have a total ED of 26 years, based upon the 90th percentile for residential occupancy (USEPA 2014). The resident child ED is assumed at 6 years to account for the age range of 0 to 6 years; therefore, the resident adult ED is 20 years (USEPA 2014). The landscaper/maintenance worker is assumed to be a long-term employee who has an employment duration of 25 years (USEPA 2014). Construction workers are assumed to be at the site for a 1-year duration (BPJ). The total ED for the recreational user is based upon the 26 years for the resident. To account for a variety of recreational user age-ranges the ED has been divided between the adult, adolescent, and child.

The exposure frequency (EF), which details how many days per year receptors contact the site, are based upon USEPA guidance and BPJ. The resident EF is 350 days/year, which assumes 7 days per week for 50 weeks (USEPA 2014). The landscaper/maintenance worker is assumed to be an outdoor worker with an EF of 225 days/year (USEPA 2014). The construction worker EF is also assumed at 250 days per year, which assumes 5 days per week for 50 weeks (USEPA 2002). The EF for the recreational user assumes to visit recreational areas every weekend (2 days per week) for 52 weeks for a total of 104 days per year.

The ingestion rate for residential exposure to soil is assumed at 100 mg/day for the adult and 200 mg/day for the child (USEPA 2014). The ingestion rate for the construction worker is taken from guidance for the calculation of the USEPA RSLs (USEPA 2021a). A construction worker soil ingestion rate of 330 mg/day is assumed. For the landscaper/maintenance worker, a soil ingestion rate of 100 mg/day is assumed for outdoor activities (USEPA 2014). For the recreational user, a soil ingestion rate equal to the resident adult (100 mg/day) is assumed for the adult recreational user, and a soil ingestion rate equal to the resident child (200 mg/day) based upon the resident child.

Dermal exposure to soil is assumed for exposed body surface areas only. The skin surface area (SA) available for contact generally assumes hands, forearms, head, and feet for the resident. The recommended SA for the adult is 6,032 cm^2 and the child is 2,373 cm^2, based on the mean SA for male and female combined (USEPA 2014 and 2021). The construction worker and landscaper/maintenance worker is only assumed to contact soil with hands, forearms, and head with a mean SA of 3,527 cm^2 (USEPA 2021). For the recreational user, the adult and child mean SA was set to the resident adult and child based upon the age range. For the adolescent recreational user, the mean SA for the head, hands, forearms, and lower legs for the age groups of 6 to <11 years (3,249 cm^2) and 11 to <16 years (4,665 cm^2) was determined to be 3,957 cm^2 (USEPA 2011). To account for the forearm and lower leg only, these body parts were assumed at 45% of the full arm and leg mean surface areas.

The inhalation of soil particulates assumes a 24-hour exposure period for the resident (USEPA 2014). The inhalation of soil particulates assumes an 8-hour workday for the construction worker and landscaper/maintenance worker. The recreational user was assumed to be present at recreational areas for 4 hours/day.

3.3 Toxicity Assessment

The toxicity assessment considers the types of potential adverse health effects associated with exposures to COPCs, the relationship between the magnitude of exposure and potential adverse effects, and the related uncertainties, such as the weight of evidence of a particular COPC's carcinogenicity in humans. USEPA guidance (USEPA 1989) specifies that the toxicity assessment be accomplished in two steps: hazard identification and dose-response assessment. Hazard identification is the process of determining whether studies demonstrate that exposure to a COPC may cause the incidence of an adverse effect. The dose-response assessment involves: (1) a quantitative evaluation of the existing toxicity information and (2) a characterization of the relationship between the dose of the COPC administered or received, and the incidence of potentially adverse health effects in the exposed population. From this quantitative dose-response relationship, specific toxicity values are derived that can be used to estimate the incidence of potentially adverse effects occurring in humans at different exposure levels (USEPA 1989).

Toxicity values will be selected according to USEPA guidance (USEPA 2003). The following hierarchy for human toxicity values will be used in the HHRAs:

- Tier 1 values – USEPA's Integrated Risk Information System (IRIS) (USEPA 2021b)
- Tier 2 values – USEPA's Provisional Peer Reviewed Toxicity Values (PPRTVs)
- Tier 3 values – Toxicity Values from other sources. Priority will be given to sources of information that use sound science and are the most current, are peer-reviewed, are transparent, and are publicly available.

The primary source of toxicity information is IRIS (USEPA 2021b). When toxicity information and factors are not available in IRIS, a secondary value is sought. Tier 2 values, USEPA's PPRTVs, are developed by the Office of Research and Development, the National Center for Environmental Assessment, and the Superfund Health Risk Technical Support Center on a chemical-specific basis when requested by the Superfund program. Tier 3, other toxicity values, are considered when Tier 1 or Tier 2 toxicity values are not available. These toxicity values are taken from additional USEPA and non-USEPA sources and are chosen based on the most current and best peer-reviewed source available. The USEPA RSL table will be the primary source for the selection of toxicity values used in the HHRAs. The USEPA RSL table selects toxicity values based upon the hierarchy identified in USEPA guidance (2003).

Carcinogenic compounds will also be assessed for mutagenic modes of action. The mutagenic mode of action is assessed with a linear approach (USEPA 2005b). COPCs identified as mutagenic have sensitivity pertaining to cancer risks associated with early-life exposures. To account for the early-life exposure and the mutagenic mode of action, the cancer potency estimates will be adjusted by an age-dependent adjustment factor (ADAF). USEPA recommends, for mutagenic chemicals, when no chemical-specific data exist, a default approach using estimates from chronic studies (i.e., cancer slope factors) with appropriate modifications to address the potential for differential risk of early life stage exposure (USEPA 2005a, 2005b). An ADAF modification for early life stage exposure to mutagenic COPCs is required because available studies indicate higher cancer risks resulting from a given exposure occurring early in life when compared with the same amount of exposure during adulthood (USEPA 2005b). The intakes for COPCs identified with a mutagenic mode of action will be modified by an ADAF for the following exposures (USEPA 2005b):

- For exposures before 2 years of age (i.e., spanning a 2-year time interval from the first day of birth up until a child's second birthday), a 10-fold adjustment.
- For exposures between 2 and <16 years of age (i.e., spanning a 14-year time interval from a child's second birthday up until their 16th birthday), a 3-fold adjustment.
- For exposures after turning 16 years of age, no adjustment.

The resident, child recreational user, and adolescent recreational user are within the age range that requires adjustment for a mutagenic mode of action. Two age groups are considered for the residential scenario, an adult and a child. The age group for the child is assumed at 0-6 years. The resident adult is evaluated from an age range of 7-26 years old (EPA 2014). Although adults are typically assumed at an age range of greater than 16 years of age, the resident adult is evaluated for a long-term exposure typical of residents (EPA 1991b). Residents are typically assumed at a duration of 26 years, so the resident adult spans that 7-26 years beyond childhood (EPA 1991a, 2021a). Therefore, both the resident child and the resident adult require an adjustment for potential mutagenic modes of action. The following equation presents an example of the mutagenic adjustment for the resident adult and child carcinogenic intake for ingestion of soil (USEPA 2005b):

$$Intake, child(mg/kg - day) = \frac{\text{EPC } x\ IRS\ x\ EF\ x\ [(ED_{0-2}\ x\ 10) + (ED_{2-6}\ x\ 3)\ x\ RBA\ x\ CF}{BW\ x\ AT}$$

$$Intake, adult(mg/kg - day) = \frac{\text{EPC } x\ IRS\ x\ EF\ x\ [(ED_{6-16}\ x\ 3) + (ED_{16-26}\ x\ 1)\ x\ RBA\ x\ CF}{BW\ x\ AT}$$

Toxicity values specific to dermal exposures are not available and require adjustment of the oral toxicity values (i.e., oral reference doses [RfDs] or slope factors [SFs]). This adjustment accounts for the difference between the daily intake dose through dermal contact as opposed to ingestion. Most toxicity values are based on the actual administered dose and must be corrected for the percent of chemical-specific absorption that occurs across the gastrointestinal tract prior to use in dermal contact risk assessment (USEPA 1989 and 2004). USEPA recommends utilizing oral absorption efficiency factors in converting oral toxicity values to dermal toxicity values (USEPA 2004). This adjustment accounts for the absorption efficiency in the "critical study," which is utilized in determining the RfD and SF. Where oral absorption in the critical study is essentially complete (i.e., 100 percent), the absorbed dose is equivalent to the administered dose, and no adjustment of oral toxicity values is necessary when evaluating dermal exposures. When gastrointestinal absorption of a chemical in the critical study is poor (e.g., 1 percent), the absorbed dose is much smaller than the administered dose, and toxicity values for dermal exposure are adjusted to account for the difference in the absorbed dose relative to the administered dose. To account for the differences between the administered (oral) and the absorbed (dermal) dose, RfDs and SFs are modified by the gastrointestinal dermal absorption factor (GIABS). Dermal modifications will be presented in the HHRAs.

3.4 RISK CHARACTERIZATION

The characterization of human health risk involves the combining of information from the exposure assessment with that from the toxicity assessment. Chemical intakes for each receptor and each exposure pathway are combined with toxicity information to derive cumulative excess lifetime cancer risks (ELCRs) and cumulative non-cancer hazard indexes (HIs). The HHRAs will present the ELCRs and HIs in tables that are USEPA RAGS D format (USEPA 2001). These tables will also present cumulative cancer risks or HIs for COPCs, pathways, and receptors.

Risk Characterization summary tables in the HHRAs will reflect the following rounding convention. Results for individual COPCs will contain two significant figures. Only one significant figure will be used for cumulative results for all exposure pathways. The methodologies used to estimate carcinogenic risks and non-carcinogenic hazards are described further in the sections below.

3.4.1 Hazard Index for Non-Carcinogenic Effects

The potential human health risks associated with exposures to non-carcinogenic COPCs are calculated by comparing the intake or the EC with the chemical-specific RfD or reference concentration (RfC), as per USEPA Guidance (USEPA 1989 and 2009). A HQ is derived for each COPC, as shown in the equation below:

$$HQ = \frac{Intake}{RfD} \quad \text{or} \quad HQ = \frac{EC}{RfC\ x\ (1{,}000\mu g/mg)}$$

where:

HQ	=	Hazard Quotient.
Intake	=	Calculated non-carcinogenic ADI (mg/kg day).
EC	=	Exposure Concentration (mg/m^3).
RfD	=	Reference dose (mg/kg day).
RfC	=	Reference concentration (mg/m^3).

If the average daily dose (intake) exceeds the RfD or RfC, the HQ will exceed a ratio of one (1.0) and there may be concern that potential adverse systemic health effects will be observed in the exposed populations. If the average daily dose (intake) does not exceed the RfD or the RfC, the HQ will not exceed 1.0 and there will be no concern that potential adverse systemic health effects will be observed in the exposed populations. In general, the greater the value of the HQ is above 1.0, the greater the level of concern. However, the HQ does not represent a statistical probability that an adverse health effect will occur. To evaluate the potential for exposure to multiple chemicals for each exposure pathway, a HI must be calculated. This approach assumes that the exposure to more than one chemical is additive and therefore, sums the HQs of all the COPCs:

$$HI = \Sigma HQ_n$$

In this aspect, synergistic and antagonistic interactions are not taken into account. Similar to the HQs, if the HI exceeds 1, the potential for non-carcinogenic adverse effects may exist. The overall receptor-specific HI is the sum of the HIs for all exposure pathways. Only one significant figure will be used for cumulative HI results for all exposure pathways. Not all chemicals affect the same systems in the human body. For each non-carcinogen, information regarding the target organ and other organ/systems that may be impacted will be collected. Where pathway-specific HIs exceed the target level of 1, noncarcinogenic hazards will be re-assessed for each target organ/system. Where organ/system-specific HIs exceed 1, the potential for adverse effect on human health may occur.

3.4.2 Carcinogenic Risks

Carcinogenic risk is calculated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. The numerical estimate of excess lifetime cancer risk is calculated by multiplying the lifetime cancer average daily intake (LADI) by the risk per unit dose (the SF) or multiplying the EC by the IUR.

This is shown in the following equation:

$$ELCR_n = LADI \times SF$$
$$ELCR_n = EC \times IUR$$

Where:

$ELCR_n$ = chemical-specific excess lifetime cancer risk for chemical “n”.
LADI = Lifetime average daily intake (mg/kg day).
EC = Exposure Concentration (µg/m^3).
SF = Cancer slope factor (mg/kg day) $^{-1}$.
IUR = Inhalation Unit Risk (µg/m^3)$^{-1}$.

Because the SF and the IUR are the statistical 95th percent upper-bound confidence limit on the dose-response slope, this method provides a conservative, upper-bound estimate of risk. To evaluate the potential for exposure to multiple chemicals for each exposure pathway, risks resulting from exposure to multiple carcinogens are assumed to be additive. Therefore, the pathway-specific ELCR is estimated by summing the risks estimated for each COPC:

$$ELCR_{soil\ exposure\ pathway} = \Sigma ELCR_n$$

Where:

$ELCR_n$ = chemical-specific excess lifetime cancer risk for chemical “n”
n = various individual carcinogenic COPCs

It is noted that the only complete or potentially complete exposure pathway for receptors is direct contact with soil. Only one significant figure will be used for cumulative risk results(USEPA 1989).

3.5 Uncertainty Analysis

Uncertainty exists in a number of elements in the risk assessment process, including (but not limited to) models used to estimate mean concentrations, assumptions used to estimate chemical intake, and the toxicity of chemicals. Some of the uncertainties inherent and introduced into the risk assessment process will be discussed in the HHRAs with a focus on key factors believed to influence the risk assessment process and that apply to risk management decisions. Uncertainties involved in each major step of the risk assessment process (i.e., hazard assessment, exposure assessment, toxicity assessment, and risk characterization) will be discussed.

Examples of elements that may be included in the uncertainty analysis are listed below:

- Hazard Assessment
    - Exclusion of non-detected chemicals in risk estimates
    - Effect of elevated RLs
- Exposure Assessment
    - Uncertainty associated with any modeled concentrations
- Toxicity Assessment
- Risk Characterization
    - The presumed additivity of risks from multiple chemicals

Each element contributing to the uncertainty of the risk results will be discussed in terms of whether the impact would likely over- or underestimate risk. The degree of potential over- or underestimation will be assessed using qualitative terms such as low, moderate, high, and extreme. For some factors of uncertainty, risk estimates may be either over-or underestimated.

ACRONYMS

ABS	Absorption factor
ADAF	Age dependent adjustment factor
ADI	Average daily intake
AF	Adherence factor
AT	Averaging time
bgs	Below Ground Surface
BLM	Bureau of Land Management
BOR	Bureau of Reclamation
BTV	Background threshold value
Broadbent	Broadbent & Associates, Inc.
BW	Body weight
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CF	Conversion factor
CFR	Code of Federal Regulations
COPC	Chemical of potential concern
CSM	Conceptual Site Model
EA	EA Engineering, Science, and Technology, Inc.
EC	Exposure concentration
ED	Exposure duration
EF	Exposure frequency
ELCR	Excess lifetime cancer risk
USEPA	Environmental Protection Agency
EPC	Exposure point concentration
ERA	Ecological risk assessment
HI	Hazard index
HHRA	Human Health Risk Assessment
HQ	Hazard quotient
IRIS	Integrated Risk Information System
IRS	Soil ingestion rate
IUR	Inhalation unit risk
LADI	Lifetime average daily intake
Lakemoor	Lakemoor Ventures, LLC
mg/kg	Milligrams per kilogram
NAC	Nevada Administrative Code
NDEP	Nevada Division of Environmental Protection
PEF	Particulate emission factor
PPRTV	Provision Peer-Reviewed Toxicity Value
RAGS	Risk Assessment Guidance for Superfund
RfC	Reference concentration
RfD	Reference dose
RL	Reporting limit
RME	Reasonable maximum exposure
RSL	Regional Screening Level

SA	Surface Area
SAP	Sampling and Analysis Plan
SF	Slope factor
SRC	Site Related Chemical
TKE	Three Kids Enterprises, LLP
UCL	Upper confidence limit
VF	Volatilization factor

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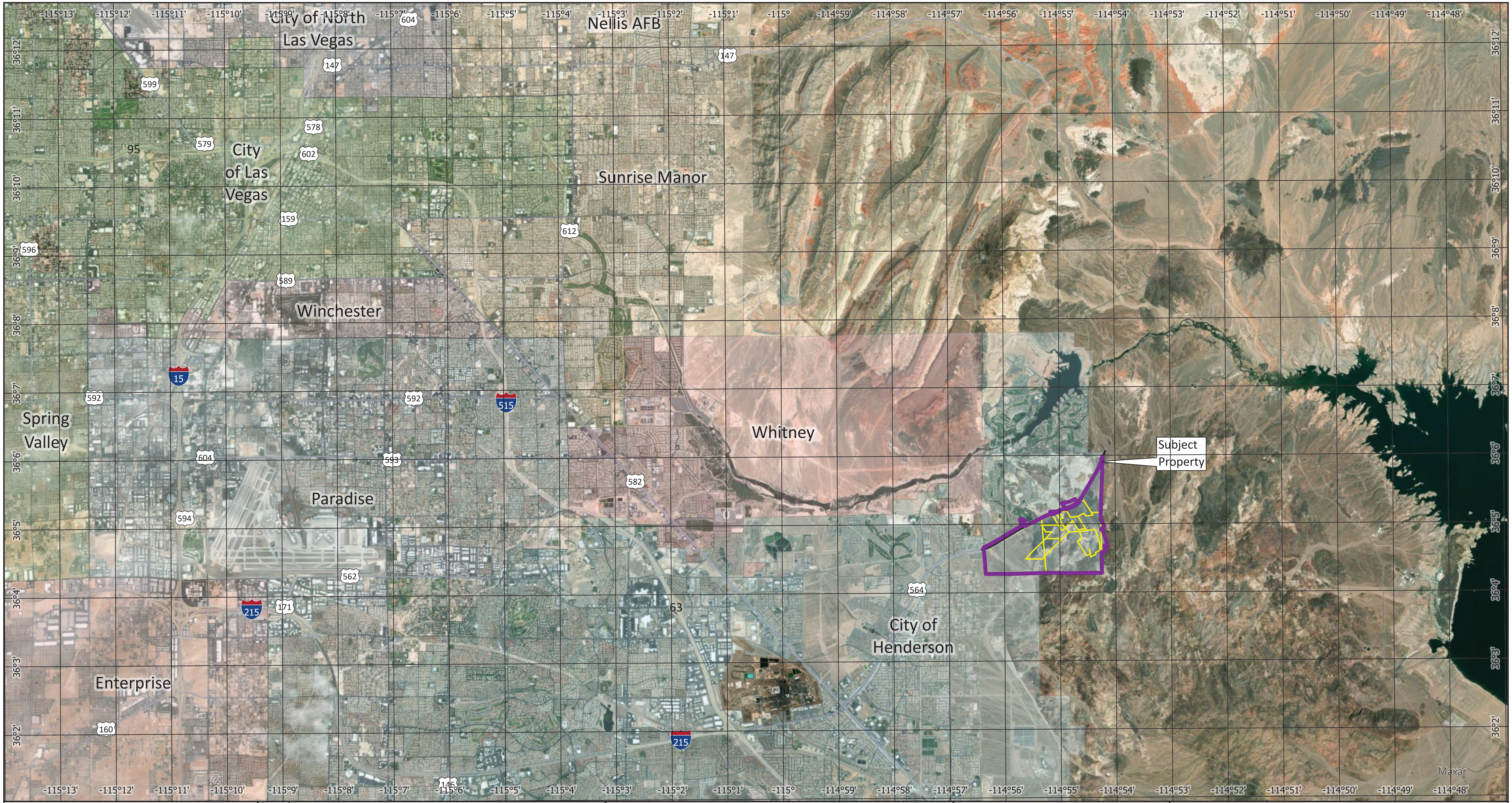
FIGURES



BROADBENT
8 West Pacific Avenue
Henderson, NV, 89015
(702) 563-0600 (P) * (702) 563-0610 (F)

Job # 14-01-156 Date: 5/1/2021

Legend:
- Subject Property
- Project Area Parcel
- City of Henderson
- City of Las Vegas
- City of North Las Vegas
- Clark County
- Enterprise
- Nellis AFB
- Paradise
- Spring Valley
- Sunrise Manor
- Whitney
- Winchester

Notes:
1. Imagery Source: Esri World Imagery
2. Datum: NAD 1983 StatePlane Nevada East FIPS 2701 Feet
3. Political Boundary Source: Clark County GIS Management Office.
4. Parcel Boundary Source: Clark County Assessor.
5. Roads Source: Nevada DOT GeoHub.

N

Scale: 1:100,000

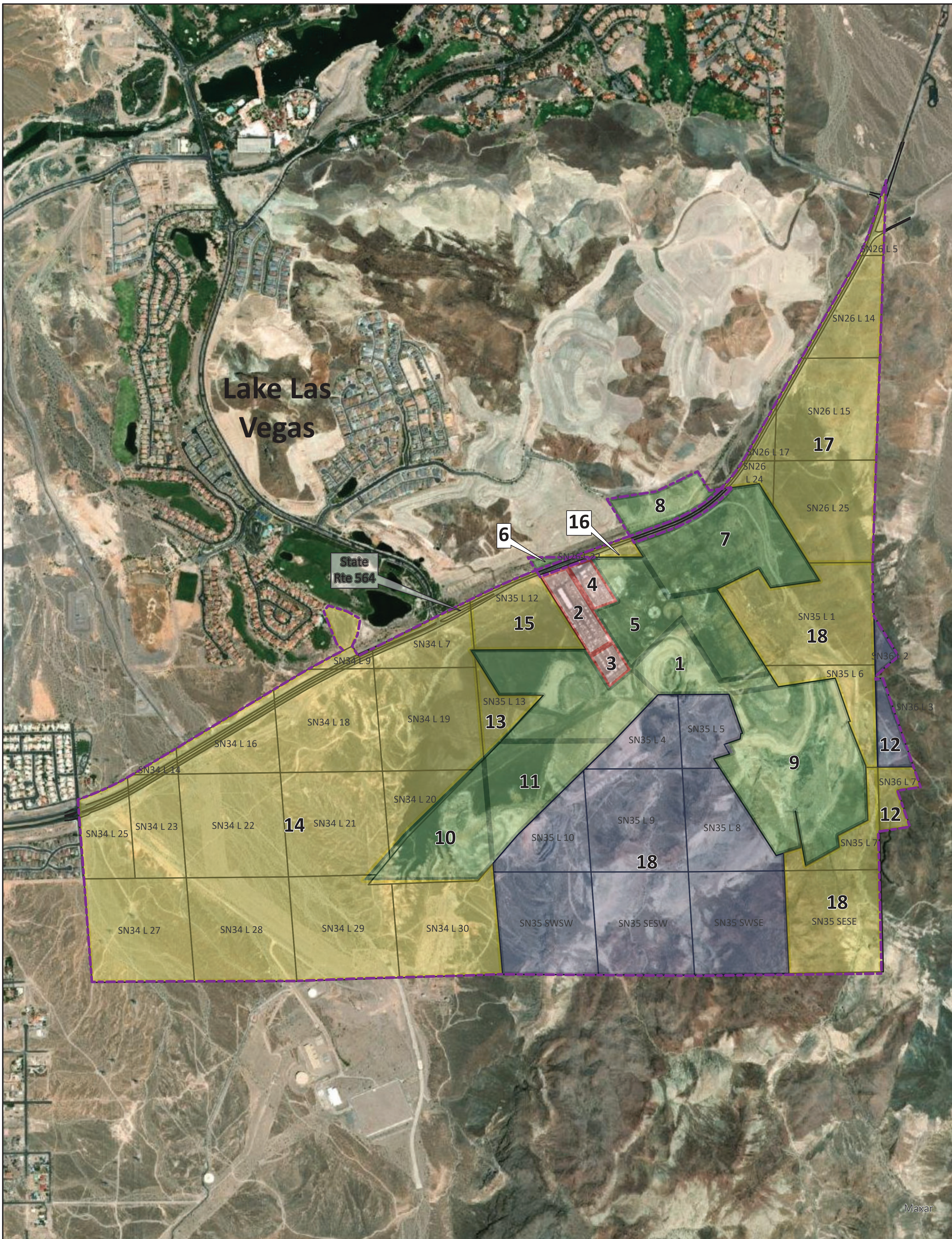
1 0.5 0 1 Miles

Figure 1

Site Location

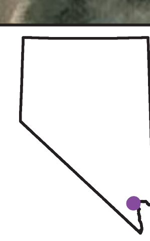
Former Three Kids Mine

Designed	
Drawn	JCM
Approved	



Legend:

- Project Area
- BOR Withdrawn
- Three Kids Inc. et al. and Kings Beach Ltd.
- M&R LP and Laker Plaza Inc.
- BLM
- Public Lands Survey System (BLM, 10/29/2020)



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Scale: 1:15,000

1,000 500 0 1,000 Feet

Figure 2

Parcel Map

Former Three Kids Mine

BROADBENT

8 West Pacific Avenue
Henderson, NV, 89015
(702) 563-0600 (P) * (702) 563-0610 (F)

Job # 14-01-156 Date: 5/1/2021

Notes:
1. Imagery Source: Esri World Imagery
2. Datum: NAD 1983 StatePlane Nevada East FIPS 2701 Feet
3. Not a survey.
4. Parcel Source: Clark County Assessor and BLM Administrative Units.

Designed	
Drawn	JCM
Approved	

Legend:

- Site Feature
- Communication Line
- Power Line
- Water Line
- Control Line
- River Mountains Trail
- Unimproved Road
- Tailings Dam
- Project Area

N

Scale: 1:14,000

1,000 500 0 1,000 Feet

Figure 3

Mill Site Layout on Aerial

Former Three Kids Mine

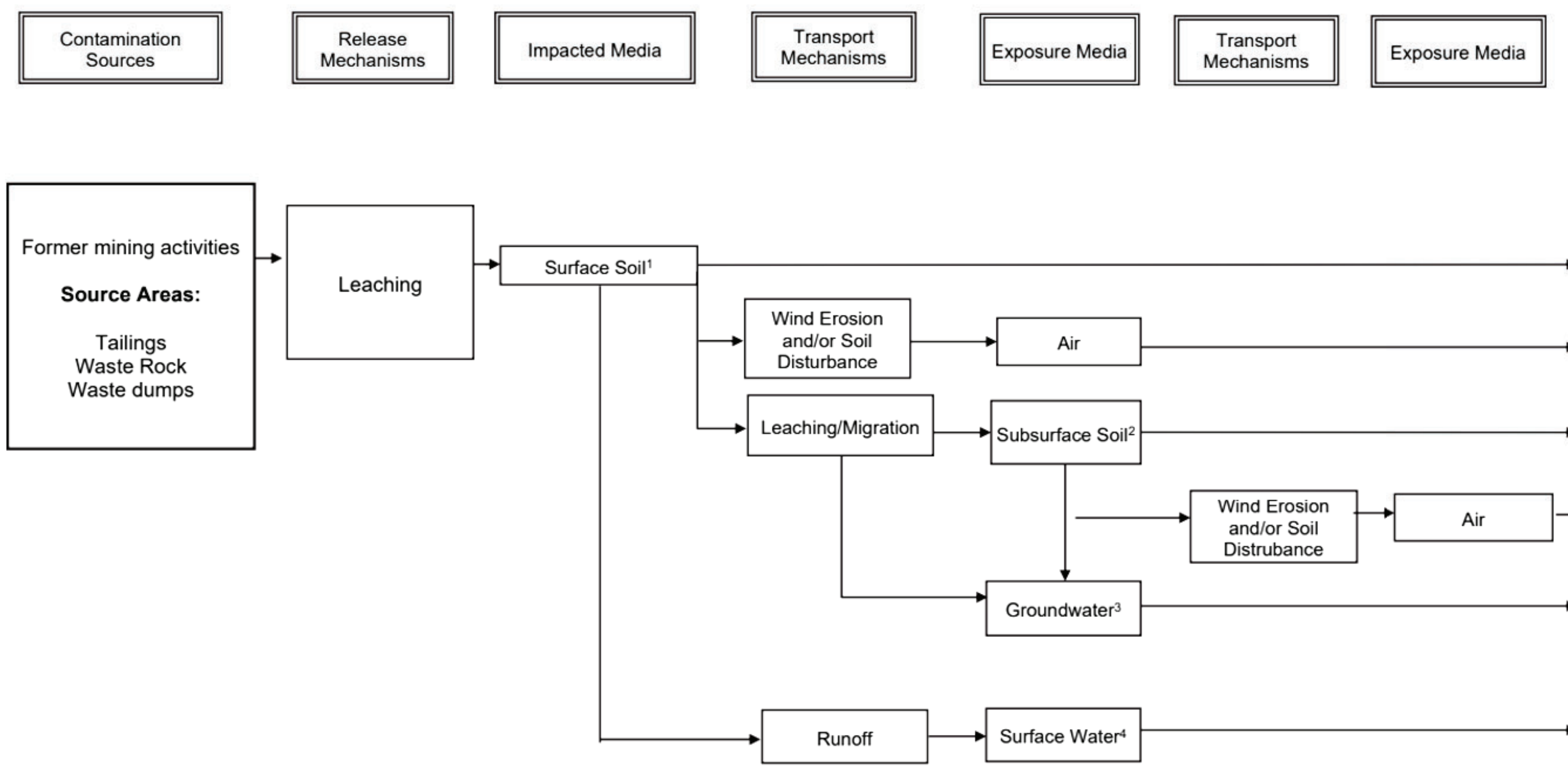
BROADBENT

8 West Pacific Avenue
Henderson, NV, 89015
(702) 563-0600 (P) * (702) 563-0610 (F)

Job # 14-01-156 Date: 5/7/2021

Notes:
1. Imagery Source: Esri World Imagery
2. Datum: NAD 1983 StatePlane Nevada East FIPS 2701 Feet
3. Not a survey. Derived from aerial imagery.

Designed	
Drawn	JCM
Approved	



Exposure Route	Construction Worker	On-Site Resident	Recreational User	Landscaper/ Maintenace Worker	Commercial User	School User	Trespasser
Ingestion	●	●	●	●	●	●	●
Dermal Contact	●	●	●	●	●	●	●
Inhalation of Fugitive Dust	●	●	●	●	●	●	●
Dermal Contact	●	●	○	○	○	○	○
Ingestion	●	●	○	○	○	○	○
Inhalation of Fugitive Dust	●	●	○	○	○	○	○
Inhalation of Volatiles	○	○	○	○	○	○	○
Ingestion	○	○	○	○	○	○	○
Dermal Contact	○	○	○	○	○	○	○
Incidental Ingestion	○	○	○	○	○	○	○
Dermal Contact	○	○	○	○	○	○	○

Receptors

BROADBENT
8 West Pacific Avenue
Henderson, NV, 89015
(702) 563-0600 (P) * (702) 563-0610 (F)

Job # 14-01-156 Date: 2/22/2022

Legend:

● Complete/Potentially Complete

○ Incomplete (no expected exposure)

Notes:
1. Surface soil is considered 0 to 2 feet below ground surface.
2. Subsurface soil is considered soil between 2 and 10 feet below ground surface.
3. Groundwater at the Site is not currently used or will not be used in the future for potable or non-potable uses. Therefore, there are no complete or potentially complete exposure pathways to groundwater.
4. Surface water bodies are not present at the Site. Additionally, stormwater runoff will be controlled post-development. Therefore, there are no complete or potentially complete exposure pathways to surface water.

Figure 4

Human Health Conceptual Site Model

Former Three Kids Mine

Designed	
Drawn	JCM
Approved	

TABLES

TABLE 1
Exposure Parameters Proposed for Three Kids Mine
Henderson, Nevada

Definition	Parameter	Units	Landscaper/ Maintenance Worker	Construction Worker	Recreational User			Resident		References
					Adult	Adolescent (6 to 16 years)	Child (0-6 years)	Adult	Child	
General Parameters										
Body Weight	BW	kg	80	80	80	44.3[a]	15	80	15	USEPA 2011, 2014
Exposure Duration	ED	years	25	1	10	10	6	20	6	BPJ; USEPA 2014
Averaging Time	AT									
Noncarcinogenic		days	9,125	365	3,650	3,650	2,190	7,300	2,190	USEPA 2014
Carcinogenic		days	25,550	25,550	25,550	25,550	25,550	25,550	25,550	USEPA 2014
Surface and Subsurface Soil Incidental Ingestion Pathway										
Soil Incidental Ingestion Rate	IRS	mg/day	100	330	100	200	200	100	200	USEPA 2021, 2014
Soil Exposure Frequency	EF	days/year	225	250	104	104	104	350	350	BPJ; USEPA 2014
Conversion Factor	CF_1	kg/mg	1E-06	1E-06	1E-06	1E-06	1E-06	1E-06	1E-06	USEPA 1989
Surface and Subsurface Soil Dermal Contact Pathway										
Skin Surface Area	SA	cm^2	3,527	3,527	6,032	3957[b]	2,373	6,032	2,373	USEPA 2011, 2014, 2021
Skin Adherence Factor	AF	mg/cm^2	0.12	0.3	0.07	0.2	0.2	0.07	0.2	USEPA 2014, 2021
Soil Exposure Frequency	EF	days/year	225	250	104	104	104	350	350	BPJ; USEPA 2014
Dermal Absorption Factor	ABS	unitless	chemical-specific	chemical-specific	chemical-specific	chemical-specific	chemical-specific	chemical-specific	chemical-specific	USEPA 2004
Conversion Factor	CF_1	kg/mg	1E-06	1E-06	1E-06	1E-06	1E-06	1E-06	1E-06	USEPA 1989
Surface and Subsurface Soil Inhalation Pathway										
Particulate Emission Factor	PEF	m^3/kg	1.36E+09	Site-Specific	1.36E+09	1.36E+09	1.36E+09	1.36E+09	1.36E+09	USEPA 2021
Soil Exposure Frequency	EF	days/year	225	250	104	104	104	350	350	BPJ; USEPA 2014
Exposure Time	ET	hour/day	8	8	4	4	4	24	24	BPJ; USEPA 2014
Conversion Factor	CF_2	ug/mg	1,000	1,000	1,000	1,000	1,000	1,000	1,000	USEPA 2009
Conversion Factor	CF_3	hours/day	24	24	24	24	24	24	24	USEPA 2009

Notes:

a. The body weight for the adolescent recreational user is the average body weight for the age range of 6 to <11 years (31.8 kg) and 11 to <16 years (56.8) from USEPA *Exposure Factors Handbook* (EFH) Table 8-2 (USEPA 2011).

b. For the adolescent recreational user, the mean SA was determined for the head, hands, forearms, and lower legs from Table 7-2 of the USEPA EFH (USEPA 2011). To account for the forearm and lower leg, these body parts were assumed at 45% of the fu arm and leg mean surface areas. The mean SA for the head, hands, forearms, and lower legs of the age groups of 6 to <11 years (3,249 cm^2) and 11 to <16 years (4,665 cm^2) for male and female children combined was determined to be 3,957 cm^2 (USEPA 2011).

c. Additional future receptors that may contact/visit the Site development include school users, trespassers, and shopping area workers/visitors as shown on the Conceptual Site Model, Figure 4. The receptors presented on this table serve as surrogates fo these additional receptors that will not be evaluated quantitatively in the risk assessment. The resident represents a surrogate receptor for school users. Recreational users and landscaper/maintenance worker serve as surrogates for the visitors/shoppers within the shopping area and any potential trespassers.

References:

BPJ = Best Professional Judgement

EFH = Exposure Factors Handbook

United States Environmental Protection Agency (USEPA), 1989. *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A)*. EPA/540/1-89/002. Interim Final. December.

USEPA, 2004. *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)*. EPA/540/R/99/005. Final. July.

USEPA, 2009. *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment)*. EPA-540-R-070-002. January.

USEPA, 2011. *Exposure Factors Handbook, 2011 Edition*. EPA/600/R-090/052F. September.

USEPA, 2014. *Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Exposure Factors.* OSWER Directive 9200.1-120-Update. 6 February 2014.

USEPA, 2021. Regional Screening Level. Available at: https://www.epa.gov/risk/regional-screening-levels-rsls

APPENDICES

APPENDIX A

Response to Comments

APPENDIX A

Responses to NDEP Comments made on March 24, 2022

1. **Section 2.1.1 Site Location** – This section indicates that the site includes seven parcels totaling approximately 851 acres under federal administration. It is unclear why the area for the federally-owned land was changed from 952 to 851 acres. The total site area provided in Section 1.1 was also changed. Per the Act, the Three Kids Mine project site consists of approximately 1,262 acres, 948 of which are federally owned. Please explain.

   The original Act listed 948 acres of federal land, but this included the 1,400' wide Bureau of Reclamation (BOR) 500kV power corridor. It has since been decided that this area is not needed in open space calculations for Lakemoor and is better kept with BOR. Therefore, the federal acreage for transfer has been reduced to 851 acres. There are other areas with existing easements that will be transferred, but those easements will stay in place and Lakemoor has been coordinating with the entities on development plans to ensure no conflicts will arise.

2. **Section 3.2.4 Calculation of Chemical Intake** – The equation for intake associated with incidental ingestion now includes "RBA," which is defined as "relative bioavailability (unitless), assumed 1 for all chemicals except arsenic, which is assumed 0.6." While including RBA in risk calculations is a standard acceptable practice, the assumptions of 0.6 for arsenic and 1 for all other chemicals do not appear to be found in USEPA 1989, which is provided as the reference for the equation. What is the reference for these assumptions?

   Acknowledged. The definition for relative bioavailability has been revised to include a reference to the EPA RSL table. The text has been revised to the following: "relative bioavailability (unitless), assumed 1 for all chemicals except arsenic, which is assumed 0.6. (USEPA 2021a)."

3. **Table 1 Exposure Parameters Proposed**
   a. Comment 29a (Appendix A) was not addressed as indicated in the response to comments. Section 3.2.2.2 states that "the residential exposure assessment will serve as a surrogate exposure for school receptors," "the commercial area receptors will be assessed with the landscapers/maintenance workers," and "the assessment of receptors identified [in Table 1] will be protective of any trespassers."
   b. Comment 29b (Appendix A) was not addressed as indicated in the response to comments. As stated in the response to comments, the body weight that will be used for the recreational adolescent user (6 to 16 years) is 44.3 kg (instead of the value of 56.8 kg listed in Table 1). How was the skin surface area of 3,947 cm2 determined?
   c. Comment 29c (Appendix A) does not appear to have been addressed as indicated in the response to comments.

a. A footnote was added to Table 1 to include the discussion from Section 3.2.2.2 that identifies the surrogate receptors that are protective of other potential receptors identified for the site.
b. The body weight for the recreational adolescent user has been corrected on Table 1 to 44.3 kg. Also, a description of how the skin surface area for the adolescent recreational user was added as a footnote to Table 1.
c. Where appropriate, the references for exposure parameters has been reduced. It is noted that most exposure parameters shown on Table 1 for the construction worker and the recreational user are not included in the USEPA 2014 reference, so additional references are included to support these values.

4. **Section 3.3 Toxicity Assessment** – Revisions made to Section 3.3 in response to comment 22 (Appendix A) included the addition of a new paragraph and intake equations. The new paragraph includes several references (EPA 1991a, 1991b, 2014, and 2021a), but it is unclear from which reference the intake equations were obtained. It would have been helpful to include 2005b, as this appears to be one of the references used for the equations.

A reference to USEPA 2005b was added to the text to support the example equations that evaluate mutagenic intakes.